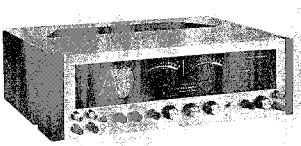
STEREO DISPLAY

SD-1000

F.W



OPERATING INSTRUCTIONS

PIONEER

We are proud to welcome you to the world-wide family of SD-1000 owners. Developed with our superb technical knowhow based on long years' experience in research and development for excellent audio instruments to satisfy today's stringent requirements, your SD-1000 always provides a variety of purposes such as measurement of frequency response and gains as well as easier observation of stereo displays of your stereo instruments, etc.

To get the most from your SD-1000, read through the operating instructions carefully.

FEATURES

EASY-TO-SEE CRT SCREEN

The 3" (75 mm) electrostatic deflection-type brightness cathod-ray tube and easy-to-see scale employed in the SD-1000, always provides bright, clean pattern with easy observation of waveforms. In addition, the SD-1000 features the automatic spot killer circuit capable of reducing the brightness of the pattern automatically when vertical and horizontal amplitude is extremely reduced, thus preventing the fluorescent materials from degrading.

EASY-TO-READ LEVEL METERS WITH VARIOUS KINDS OF SENSITIVITY

For easier direct reading dB values signals, a pair of large-size level meter is arranged right in the center of the front panel. A 10dB-step attenuator and two different sensitivity input terminals provided on the front and rear panels, function best to select sensitivity of the meters, also enabling a measurable signal to cover a range from 10mV to 20V

BUILT-IN AUDIO OSCILLATOR

The sweep-automatic audio oscillator built in the SD-1000, when set to SWEEP AUTO, is available for an exclusive use in an automatic sweep within a 20Hz~20kHz range in as short as about 25 seconds. Additionally, manual operation except for the SWEEP AUTO position permits you to sweep the same range.

The output amplitude is controllable with the level control knob to enable the oscillator to stop due to no output leakage from the oscillator with the knob set to OFF

SIMPLE SELECTION OF INPUT SIGNAL

The push-button signal selecting switches, on the front panel, permit waveform observation of input signals fed from two pairs of input terminals on the front panel or four pairs of input terminals on the rear panel. Especially, through push-button controls on the front panel, the four input terminals are used when observing a stereo display of a four-channel stereo system.

VERSATILE APPLICATIONS

By a combined operation of the built-in oscillator and an upgraded microphone connected to the SD-1000, acoustic frequency response in your listening room can be checked. What's more, the SD-1000 can provide many other applications such as observation of a stereo display, measurement of phase shift by means of a Lissajous pattern, measurement of stereophonic sound by observing a difference in level of output signals, and also checking of frequency response of a cartridge while playing a stereo test record.

FM MULTIPATH OBSERVATION

As one of the SD-1000 features, provided on the rear panel are the FM multipath terminals for use in connecting them to your tuner's FM multipath terminals if they are provided. The pattern will give you a guide in determining FM antenna direction and height necessary for the optimum reception of FM stereo signals.

INSTALLATION

Since the SD-1000 is a transistorized equipment, there is very few heat generation from itself, but the following places is not recommended for installation of SD-1000.

- A place where the SD-1000 may be exposed to the direct ray of the sun or a place near any room heater.
- On the top of stereo amplifier especially, be careful not to place your SD-1000 on top of a tube-type amplifier.
- A place where there is much dust or humidity.
- Near leakage AC flux.

EXAMPLES FOR USE

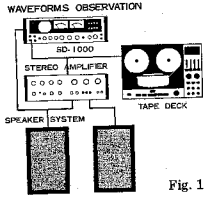


Fig. 1

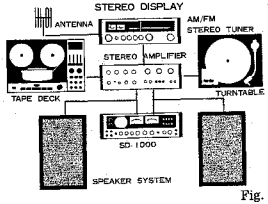


Fig. 2

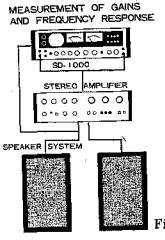


Fig. 3

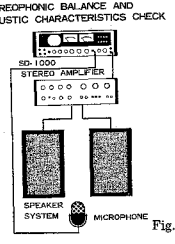


Fig. 4

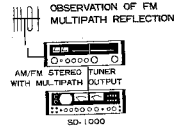


Fig. 5

BEFORE OPERATION

INPUT TERMINALS (BINDING POSTS)

The SD-1000 is provided with two pair binding posts on the front panel and four pairs on the rear panel. To use either front or rear input can be selected by means of the push-button switch, see Fig. 6. As the input terminals on the rear panel are connected to attenuator of 20dB, they can be used when high level input signal is fed to the SD-1000.

SPOT KILLER CIRCUIT

To prevent the cathode-ray tube from degrading, the SD-1000 is provided with the spot killer circuit which functions to reduce the brightness of pattern when vertical and horizontal amplitude is reduced to less than 3/8" (10mm). You may notice this when you are observing a Lissajous pattern of stereo music because the brightness of the pattern is reduced between each interval of music.

LEVEL METERS

When the deflection of the pointer of the level meter is too small for accurate reading, set the level meter selector switch to "-10" or "-20". For instance, if the level meter indicates -10~-20 with the level meter selector switch set to "0", set the switch to "-10". The pointer should indicate 0~-10 as shown in Fig. 7. Be sure not to allow the pointer swing all the way up to the end of the scale.

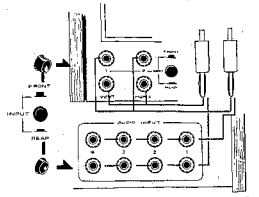


Fig. 6

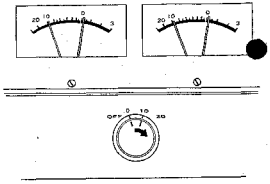


Fig. 7

CONNECTION DIAGRAM

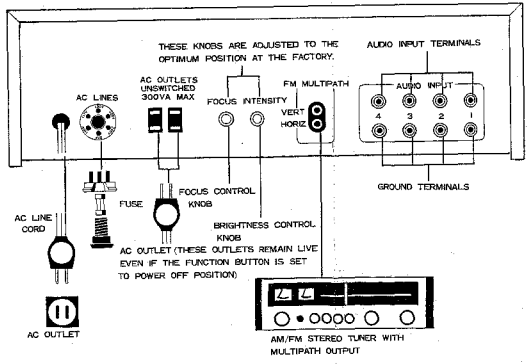


Fig. 8

FRONT PANEL FACILITIES

VERTICAL POSITION KNOB:
Turning the knob clockwise moves the pattern on the screen upward; turning the knob counterclockwise moves the pattern downward.

HORIZONTAL POSITION KNOB:
Turning the knob clockwise (C.W) moves the pattern on the screen to the right; turning the knob conterclockwise (C.C.W) moves the pattern to the left.

INPUT TERMINALS 2 (HORIZ):
High sensitivity input terminal for horizontal amplifier, other is the same as INPUT TERMINAL 1.

INPUT TERMINALS 1 (VERT):
High sensitivity input terminals for vertical amplifier, these terminals are used when observing a low level input signal. The upper is for positive (+) and the lower is for negative (-) (ground).

FRONT-REAR SELECTOR SWITCH:
This push-button switch is set to FRONT when the INPUT TERMINALS 1 or 2 are used; to REAR when the AUDIO INPUT TERMINALS on the rear panel are used. If this switch is depressed, it is locked and set to REAR, and depressed once again, it is released and set to FRONT.

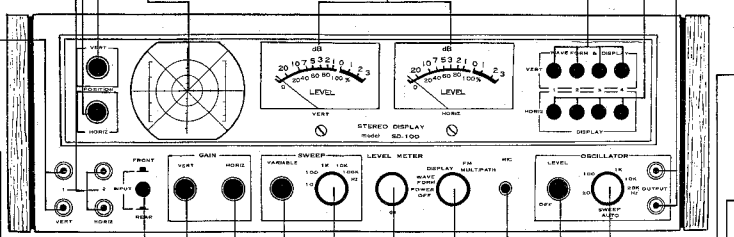
VERTICAL GAIN KNOB:
Turning this knob clockwise allows vertical amplitude of the waveform on the screen to increase.

HORIZONTAL GAIN KNOB:
Turning this knob clockwise allows horizontal amplitude of the waveform on the screen to increase.

SWEEP RANGE SWITCH AND SWEEP VARIABLE CONTROL KNOB:
Horizontal sweep frequency controls, select the sweep frequency is concerned to visible waveform cycle and stay lock pattern on the screen, if vertical input frequency and horizontal sweep frequency are same, you can observe one cycle pattern, if sweep is lower than VERT input frequency, CRT shows number of cycle to you. Note that these switch and knob will be activated only when the FUNCTION SWITCH is set to WAVEFORM.

CATHODE-RAY TUBE (CRT) SCREEN:
All pattern, waveform or display appear on this screen. Signal level can be read by scale from the amplitude of the waveform on the screen.

LEVEL METERS:
Direct reading of input level for decibel unit. Measuring input signal is applied through the AUDIO INPUT TERMINALS on the rear panel, add 20dB to the reading on the scale.



LEVEL METER SELECTOR SWITCH:
OFF ..... The LEVEL METERS will not function.
-0 ..... When signal of 2V(rms) is applied to the INPUT TERMINALS "1" or "2", the LEVEL METER(S) will indicate 0 dB.
-10 ..... When signal of 0.63V (-10 dB to 2V) is applied to the INPUT TERMINALS "1" or "2", the LEVEL METER(S) will indicate 0 dB.
-20 ..... When signal of 0.2V (-20 dB to 2V) is applied to the INPUT TERMINALS "1" or "2", the LEVEL METER(S) will indicate 0 dB.

WAVEFORM & DISPLAY SELECTOR SWITCHES (VERT):
Switch numbers 1 to 4 correspond to the input terminal numbers. The switch corresponding to the input terminals used should be depressed.

DISPLAY SWITCHES (HORIZ):
Switch numbers 1 to 4 correspond to the input terminal numbers. When observing a Lissajous pattern on the screen, the switch corresponding to the input terminals used should be depressed.

OSCILLATOR OUTPUT TERMINALS:
These are output terminals for the built-in audio oscillator. The upper terminal is for positive (+); the lower terminal is for negative (-) (ground).

OSCILLATOR FREQUENCY CONTROL KNOB:
Any frequency from 20 Hz to 20 kHz can be selected by means of this control knob. With the knob set to SWEEP AUTO, the oscillator will continuously sweep frequencies from 20 Hz to 20 kHz automatically at approx. 25 seconds for one sweep cycle.

OSCILLATOR LEVEL CONTROL KNOB:
Turning this knob clockwise increases output of the oscillator. With this knob set to OFF, the oscillator stops operating. Be sure to keep the knob set to OFF when the oscillator is not in use.

MIC JACK:
Waveform of the sound picked up by a microphone can be observed by connecting a dynamic microphone into this JACK. At the time, the LEVEL METER (VERT) will be activated and shows sounds level. Be sure to remove the microphone when it is not used.

FUNCTION SWITCH:
POWER OFF ..... Turns power off.
WAVEFORM ..... For observing waveforms selected with the WAVEFORM & DISPLAY SELECTOR SWITCH.
DISPLAY ..... For observing a Lissajous pattern selected with the WAVEFORM & DISPLAY SELECTOR SWITCH and the DISPLAY SWITCH.
FM MULTIPATH ..... For observing FM multipath reflection.

WAVEFORM OBSERVATION AND MEASUREMENT

WAVEFORM OF THE AUDIO OSCILLATOR OUTPUT

1. Connect the power cord to an AC outlet.
2. Connect the INPUT TERMINALS "1" to the OSCILLATOR OUTPUT TERMINALS with a cord.
3. Set the FUNCTION SWITCH to WAVEFORM. Power will be turned on.
4. See if the WAVEFORM & DISPLAY SELECTOR SWITCH "1" is depressed and the FRONT-REAR SELECTOR SWITCH is set to "FRONT".
5. Set the following control knobs as specified below.
   OSCILLATOR FREQUENCY CONTROL KNOB
   ..... 1K
   OSCILLATOR LEVEL CONTROL KNOB
   ..... At a middle point
   SWEEP RANGE SWITCH
   ..... 100 or 1K
6. A pattern will appear on the CRT screen. If the pattern is moving on the screen, turn the SWEEP VARIABLE CONTROL KNOB until the pattern stays stationarily.
7. If necessary, adjust the pattern position by VERTICAL POSITION KNOB; or HORIZONTAL POSITION KNOB.
8. Adjust the vertical amplitude by turning the VERTICAL GAIN KNOB; the horizontal amplitude by turning the HORIZONTAL GAIN KNOB.
9. Set the LEVEL METER SELECTOR SWITCH to "0". The pointers of the LEVEL METERS will deflect.
10. The reading of each LEVEL METER indicates the level of the input signal for SD-1000 also output level of built-in audio oscillator.

Note: If, with the LEVEL METER SELECTOR SWITCH set to "0", METER deflection is too small for accurate reading, set the switch to either "−10" or "−20"

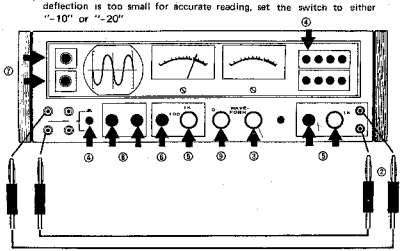


Fig. 9

CALIBRATION OF AMPLITUDE

1. Connect the OSCILLATOR OUTPUT TERMINALS to the INPUT TERMINALS "1" with a cord.
2. Set the FRONT-REAR SELECTOR SWITCH to FRONT.
3. Depress the WAVEFORM & DISPLAY SELECTOR SWITCH "1".
4. Set the FUNCTION SWITCH to DISPLAY.
5. Set the OSCILLATOR FREQUENCY CONTROL KNOB to 1K, and turn the OSCILLATOR LEVEL CONTROL KNOB fully clockwise.
6. Set the LEVEL METER SELECTOR SWITCH to "0". The LEVEL METER (VERT) will indicate a point close to 0 dB.
7. The LEVEL METERS are calibrated in such a way that 0 dB corresponds to 2V (rms) when the INPUT TERMINALS "1" are used and LEVEL METER SELECTOR SWITCH is set at "0" position.
8. If amplitude height of waveform is to be calibrated at 1V (rms), turn the OSCILLATOR LEVEL CONTROL KNOB until the pointer of the LEVEL METER indicates –6 dB.
9. The CRT screen will show the waveform of input signal of 1V. Stop the waveform by controlling the SWEEP RANGE SWITCH and the SWEEP VARIABLE CONTROL KNOB.
10. Adjust the VERTICAL GAIN KNOB and get same height of waveform 2 or 3 scales, for example.

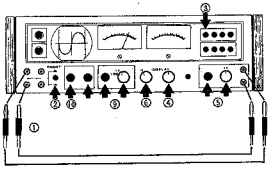


Fig. 10

Notes:
(1) If amplitude is adjusted to 5cm, voltage of input signal shows 0.2V per centimeter. From this relation between voltage and amplitude, the other unknown input signal voltage can be measured.
(2) When measuring voltage from amplitude of a waveform on the screen, do not turn the VERTICAL GAIN KNOB after the amplitude has been calibrated.
(3) When obtaining the reference voltage of 0.1V, set the LEVEL METER SELECTOR SWITCH to "-20" and turn the LEVEL CONTROL KNOB until the pointer of the LEVEL METER indicates –6 dB.
(4) When calibrating amplitude of waveform of input signal fed from the AUDIO INPUT TERMINALS "1" on the rear panel, be sure to set the FRONT-REAR SELECTOR SWITCH to REAR.

CHECK OF OSCILLATING FREQUENCY

If a calibrated audio oscillator is available, the oscillating frequency of the SD-1000 can be checked by the following steps.

1. Connect the output of the calibrated audio oscillator to the INPUT TERMINALS "1" of the SD-1000, and connect the OSCILLATOR OUTPUT TERMINALS of the SD-1000 to the INPUT TERMINALS "2".
2. Set the FUNCTION SWITCH to WAVEFORM, and depress the WAVEFORM & DISPLAY SELECTOR SWITCH "1"
3. Feed output signal of 1 kHz from the calibrated audio oscillator to the SD-1000. Waveform will appear on the CRT screen. Adjust various control knobs and switches so that the waveform for one cycle will appear on the screen.
4. Depress the WAVEFORM & DISPLAY SELECTOR SWITCH "2" and turn the OSCILLATOR FREQUENCY CONTROL KNOB until the exactly same waveform will appear on the CRT screen as in the case of 3 above. Never use the SWEEP RANGE SWITCH and the SWEEP VARIABLE CONTROL KNOB in this case.
5. If the CRT screen shows a waveform for one cycle, the oscillating frequency of the SD-1000 is 1 kHz. Likewise, a waveform for two cycles or four cycles represents oscillating frequency of 2 kHz or 4 kHz, respectively. (Fig. 11)
6. By varying frequency of output from the calibrated audio oscillator, the oscillating frequency of the SD-1000 can be checked at each frequency from 20 Hz to 20 kHz.

Note: For this frequency check, a test record or test tape with signal of predetermined frequency recorded can be used instead of a calibrated audio oscillator.

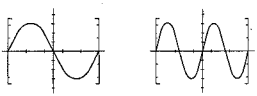


Fig. 11

WAVEFORM OF AMPLIFIER OUTPUT SIGNAL

1. Connect dummy load(s) to the output terminals for speaker of the amplifier.

Notes: (1) Pattern can be observed with the speaker systems connected to the amplifier.
(2) It is suggested that an 8-ohm resistor having a power capacity twice as large as the rated output of the amplifier be used as the dummy load.

2. Connect the OSCILLATOR OUTPUT TERMINALS of the SD-1000 to AUX input terminals under the testing amplifier with a cord. Likewise, connect the output terminals of the amplifier to the AUDIO INPUT TERMINALS of the SD-1000.
3. Check that the WAVEFORM & DISPLAY SELECTOR SWITCH "1" is depressed, and then, set the FRONT-REAR SELECTOR SWITCH to REAR.
4. Set the FUNCTION SWITCH to WAVEFORM.
5. Apply test signal from SD-1000 oscillator by turning OSCILLATOR LEVEL KNOB.
6. Adjust the pattern for easier observation by the SWEEP RANGE SWITCH and the SWEEP VARIABLE CONTROL KNOB.
7. If necessary, adjust the position and amplitude of the waveform by the VERTICAL GAIN, HORIZONTAL GAIN, VERTICAL POSITION, and HORIZONTAL POSITION KNOBS.

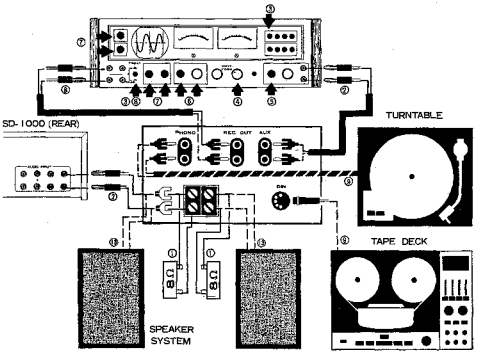


Fig. 12

8. If desired, output signal can be fed to the SD-1000 from the REC OUT terminals of the amplifier. In this case, connect the INPUT TERMINALS "1" of the SD-1000 to the REC OUT terminals of the amplifier, and release the locked FRONT-REAR SELECTOR SWITCH to FRONT.

FOR OBSERVING WAVEFORMS OF MUSIC

9. Connect turntable, tape deck or tuner to the testing amplifier.
10. Connect the input terminal of SD-1000 to the amplifiers output.
11. Operate the amplifier and the connected turntable or others.
12. Adjust the pattern on the CRT screen by controlling the VERTICAL GAIN and SWEEP KNOBS.
13. With the speaker systems connected to the amplifier, the waveforms can be observed while listening to the music.

FOR OBSERVATION WITH BUILT-IN OSCILLATOR

To measure the maximum output of your amplifier, feed input into the CRT until the perfect-shaped waveform appears on the CRT screen, and then read the pointer-deflection in the LEVEL METERS, which precisely indicate the maximum output. The perfect-shaped waveform always keeps appearing just before clipping. (Fig. 13)

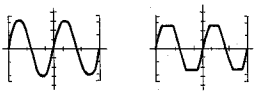


Fig. 13

STEREOPHONIC BALANCE AND ACOUSTIC CHARACTERISTICS

By connecting a high-quality microphone for measurement to the SD-1000, stereophonic balance and acoustic characteristics of the room with stereo system can be checked. (Fig. 14)

1. Connect the OSCILLATOR OUTPUT TERMINALS of the SD-1000 to the AUX input terminals of the amplifier.
2. Place the microphone (impedance: about 50 kΩ) in front of the two speakers at an equal distance from each speaker as shown in Fig. 15
3. Connect the microphone plug to the MIC JACK of the SD-1000. Set the FUNCTION SWITCH to WAVEFORM.
4. Set the OSCILLATOR FREQUENCY CONTROL KNOB to 1K, and turn the OSCILLATOR LEVEL CONTROL KNOB clockwise.
5. Operate the stereo system, and then, operate the left-channel speaker only.
6. Set the SWEEP RANGE SWITCH to 100 or 1K, and pattern is locked on the CRT screen by turning the SWEEP VARIABLE CONTROL KNOB.
7. Adjust the amplitude of the waveform with the VERTICAL GAIN KNOB.
8. Select the LEVEL METER SELECTOR SWITCH to "0", "-10", or "-20" for easier reading. Then read the indication on the scale of the LEVEL METER.

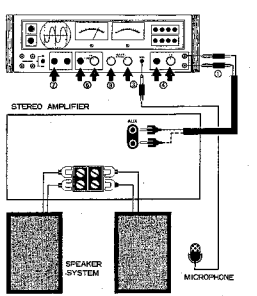


Fig. 14

9. Turn the left-channel speaker off, and operate the right-channel speaker only. Read the indication on the scale of each LEVEL METER in the same step as in 8 above.
10. If the readings obtained in steps 8 and 9 are much different, it means that stereo acoustic balance is not proper. It is suggested that the stereo system including room acoustic be checked.
11. For observing respective stereo balances of each frequency, set the OSCILLATOR FREQUENCY CONTROL KNOB to SWEEP AUTO.
12. For observing stereo characteristics of your stereo instruments, together with the characteristics inherent in your listening room, put a microphone by all means on the same place that you are used to listen to music.
13. For adjusting a multi-amplifier such as consisting of tweeter, mid-range, and woofer for example, observe the frequency corresponding to each of speakers with a microphone put alternately in closer front of each.

Notes: (1) If the oscillator output is too much, the pattern may be distorted or speakers may be damaged.
(2) Do not turn the control knobs and switches from proper setting position at first during observing the patterns and reading the level.

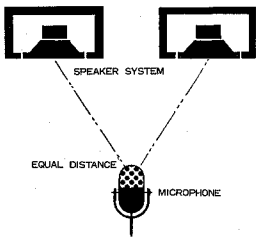


Fig. 15

STEREO DISPLAY

With the left-channel signal and the right-channel signal fed to the SD-1000, a Lissajous pattern can be obtained on the CRT screen, which allows simultaneous observation of construction of stereo sounds. It also provides patterns for stereo or mono signal and peak level.

1. Connect tuner, turntable, etc. to the amplifier.
2. Connect the output terminals of the amplifier to the AUDIO INPUT TERMINALS "1" and "2" of the SD-1000: connect the left-channel output terminals to the AUDIO INPUT TERMINALS "1", and the right-channel output terminals to the AUDIO INPUT TERMINALS "2".
3. Set the FUNCTION SWITCH to DISPLAY.
4. Set the FRONT-REAR SELECTOR SWITCH to REAR.
5. Operate the stereo amplifier and the connected audio equipment.
6. Depress the WAVEFORM & DISPLAY SELECTOR SWITCH "1" and the DISPLAY SWITCH "1".

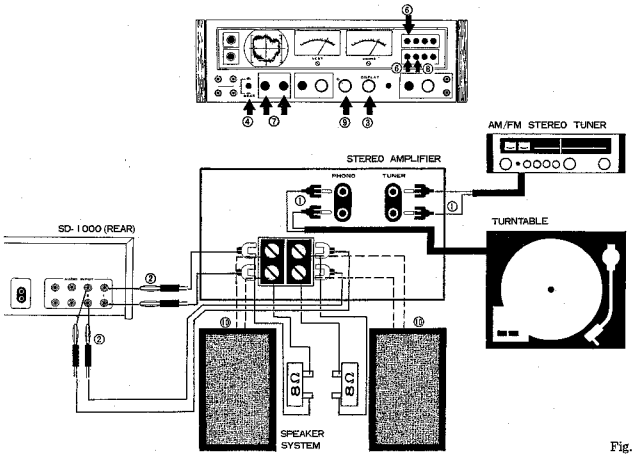


Fig. 16

7. Control the VERTICAL GAIN KNOB and the HORIZONTAL GAIN KNOB so that the CRT screen will show a straight line crossing the crosspoint of the vertical axis and the horizontal axis on the screen at 45° with respect to the horizontal axis as shown in Fig.17. This straight line is the pattern for mono signal.
8. With the DISPLAY SWITCH "2" depressed, the straight patterns change to movement circular by difference between each channel signal of stereo.
9. With the LEVEL METER SELECTOR SWITCH set to "0", the LEVEL METER (VERT) indicates the left-channel signal; the LEVEL METER (HORIZ), shows right-channel signal.
10. If the speaker system is connected to the output terminals of the stereo amplifier, the stereo display can be observed while listening to the music.

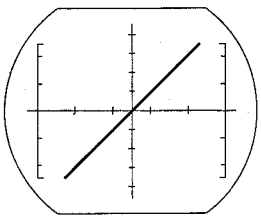


Fig. 17

MEASUREMENT OF PHASE SHIFT ANGLE

Phase shift of an amplifier can be checked by a Lissajous pattern to use output and input signals of amplifier for a Lissajous pattern.

1. Connect a preamplifier or stereo amplifier to the SD-1000 as shown in Fig. 18.
2. Feed input signal to the INPUT TERMINALS "2" and obtain a horizontal pattern shown in (a) of Fig. 19.
3. Feed input signal to the INPUT TERMINALS "1" and obtain a vertical pattern in the same manner as in 2 above.
4. Obtain a Lissajous pattern on the CRT screen by setting the followmg switches as specified below.
   WAVEFORM & DISPLAY SELECTOR SWITCH 1
   DISPLAY SWITCH 2
   FUNCTION SWITCH ..... DISPLAY
5. The CRT screen will show a Lissajous pattern shown in (c) of Fig. 19.
6. Phase angle θ can be obtained as follows:

   $\sin \theta = B/A$

   Where A. Length of the horizontal pattern obtained in 2 above.
   B: Distance between two points at which the Lissajous pattern crosses the horizontal axis.

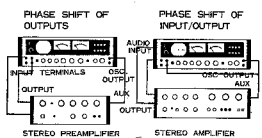


Fig. 18

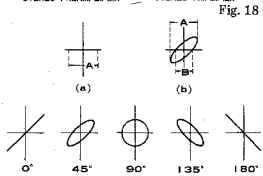


Fig. 19

OBSERVATION OF DISPLAY FOR 4-CHANNEL STEREO SYSTEM

The case of in "2 - 2 speaker system" (two speakers in front of a listener and two speakers in the rear of the listener) are to be observed, connect the output terminals of the four speakers to the SD-1000 as follows:

Speakers in the front: Left-channel output to the AUDIO INPUT TERMINALS "1".
Right-channel output to the AUDIO INPUT TERMINALS "2".

Speakers in the rear: Left-channel output to the AUDIO INPUT TERMINALS "3".
Right-channel output to the AUDIO INPUT TERMINALS "4".

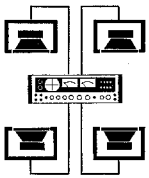


Fig. 20

1. Set the FUNCTION SWITCH to DISPLAY and the FRONT-REAR SELECTOR SWITCH to REAR.
2. Reproduce 4-channel signals and depress the WAVEFORM & DISPLAY SELECTOR SWITCH and the DISPLAY SWITCH corresponding to the signal to be checked. Adjust the pattern on the CRT screen by controlling the VERTICAL GAIN KNOB and the HORIZONTAL GAIN KNOB for easier observation.
3. By repeating the same steps as in 2 above, difference in the level of output signal of each channel can be measured.
4. For convenience in observation, the WAVEFORM & DISPLAY SELECTOR SWITCH and the DISPLAY SWITCH can be used to select four signals optically, thereby permitting the observation of waveform and phase angle at the same time.

MEASUREMENT OF VOLTAGE AND POWER

MEASUREMENT OF LOW LEVEL SIGNAL

1. Use the INPUT TERMINALS "1".
2. If calibration of amplitude is completed, voltage and power (including peak value) can be obtained from the waveform on the CRT screen.
3. Since the LEVEL METERS provide a direct reading of a level in dB, voltage and power value can be obtained from the Diagram on page 15. The solid line is to be used for obtained voltage; the dotted line, for power.
4. If the level is 0 dB, the voltage is obtained as 2V by solid line, if the level is -6dB, the voltage is 1V, and -10 dB is obtained as 0.63V.
5. Likewise, if the level is 0 dB, the power of the signal is obtained as 500 mW; the level is -6 dB, the power is 125 mW; and -10 dB is 50 mW.

MEASUREMENT OF HIGH LEVEL SIGNAL

1. Measuring signal can be directly fed to the AUDIO INPUT TERMINALS "1" if that signal is from 2V to 20V or 500 mW to 50 W on an 8-ohm-load.
2. If calibration of amplitude is completed, voltage and power (including peak value) can be obtained from the waveform on the CRT screen.
3. Voltage and power of input signal can be obtained from the Diagram blow and the reading of the LEVEL METERS as in the case of measurement of a low level signal. Multiply the voltage indicated on the Diagram by 10 to obtain the voltage for an input signal. Likewise, to obtain the power, multiply the power indicated on the Diagram by 100.
4. The level is 0 dB, the voltage of the input signal is obtained as 20V (10 times 2V).
5. Likewise, if the level is 0 dB, the power is obtained as 50W (100 times 500 mW).
6. When levels more than 50W (8ohms) are measured, the measurement should be made with an attenuator as shown in Fig. 21.

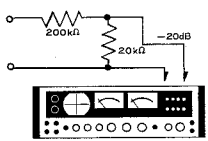
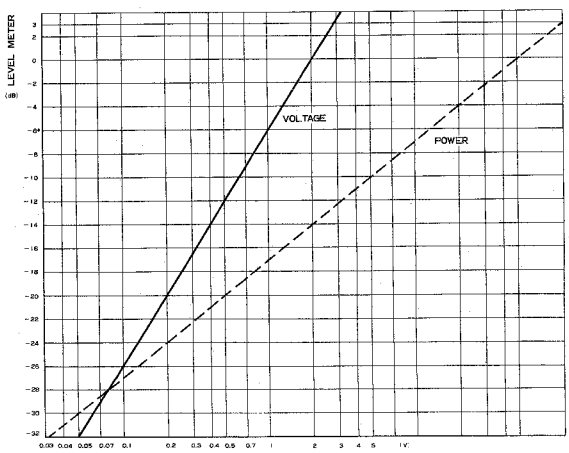


Fig. 21



Note: Load impedance of both lines shown here is in case of 8Ω.

OTHER USAGE

MEASUREMENT OF AMPLIFIER'S GAIN

Amplifier's gain is the following formula:

$$\text{VOLTAGE GAIN (Av)} = \frac{\text{output voltage}}{\text{input voltage}}$$

or Av (dB) = output level (dB) - input level (dB)

1. Measuring connector as shown in Fig. 22
2. By observing the pattern on the CRT screen, read the signal level at the time the FRONT-REAR SELECTOR SWITCH is set to FRONT and that at the time the switch is set to REAR.
3. For instance, if the reading is -10 dB with the FRONT-REAR SELECTOR SWITCH set to FRONT, and -5 dB with the SWITCH set to REAR, the gain can be obtained as follows:

   Gain (dB) = (-5 dB) - (-10 dB) + *20 dB = 25 dB

   * Fixed attenuation value for rear input.

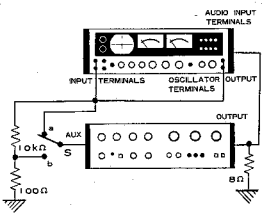


Fig. 22

Note : For measuring a gain of high sensitive amplifier to set the switch S to "b" position in Fig.22, and use the following formula:

Gain (dB) = (Reading of level input signal fed from the AUDIO INPUT TERMINALS of rear panel) − (Reading of level input signal fed from the INPUT TERMINALS of front panel) + 60 dB

In this case, the OSCILLATOR FREQUENCY CONTROL KNOB set to SWEEP AUTO and reading REAR INPUT LEVEL, you can check various gains in 20Hz to 20kHz range automatically.

CHECK OF FREQUENCY CHARACTERISTICS WITH BUILT-IN OSCILLATOR

For observing frequency characteristics of amplifier, set the OSCILLATOR FREQUENCY CONTROL KNOB to SWEEP AUTO (Fig. 23)

1. Equalizer characteristics are as shown in (a).
2. Tone control characteristics are as shown in (b).
3. Frequency response of power amplifier are as shown in (c).

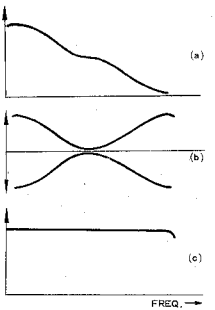


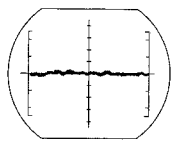
Fig. 23

OBSERVATION OF FM MULTIPATH REFLECTION

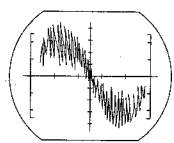
FM signals are usually reflected from objects such as large buildings or hills, etc. and reach the antenna from many directions. The signals therefore become noisy and distorted, sometimes. If the multipath reflection can be checked, this type of distortion can be eliminated or minimized by changing the direction of the antenna or by rearranging the antenna setup.

If an FM tuner provided with FM multipath terminals is available, FM multipath reflection can be checked with the SD-1000 and the FM tuner by the following steps.

1. Connect the MULTIPATH OUTPUT terminal of FM tuner to the FM MULTIPATH TERMINALS of the SD-1000 with the cord furnished with the SD-1000. Note that the upper terminal of the FM MULTIPATH TERMINALS of the SD-1000 is for vertical (VERT) and the lower terminal is for horizontal (HORIZ).
2. Set the FUNCTION SWITCH to FM MULTIPATH.
3. Adjust the amplitude of the pattern on the CRT screen by controlling the VERTICAL GAIN KNOB and the HORIZONTAL GAIN KNOB.
4. Select an FM station which is located far from your area and tune in to the station at the time an announcement is being made.
5. If there is no multipath reflection, the CRT screen will show a straight horizontal line as in (a) of Fig. 24. If there is much multipath reflection, the CRT screen will show various patterns as in (b) of Fig. 24. If there is much multipath reflection, rearrange the antenna setup so that the pattern on the CRT screen may become a straight horizontal line or a pattern close to a straight line.



ANTENNA DIRECTION IS GOOD.



CHECK OF ANTENNA DIRECTION IS REQUIRED.

Fig. 24

CHECKING CHARACTERISTICS OF A CARTRIDGE

Frequency response, trackability and channel separation of a cartridge can be checked by the SD-1000. As illustrated in Fig. 26, connect a turntable to a standard preamplifier connected to the SD-1000, and play a test record with the cartridge to be checked.

Use of test record STR-5001, STR-5002, STR-100, STR-101 of C B S or QR-2009 of B&K is recommended. Preamplifier must be such that is capable of providing equalizing response calibrated within ±1 dB from RIAA standard characteristics for magnetic cartridge. (PIONEER's SC-700, or SC-100 is recommended.)

CHECKING FREQUENCY RESPONSE

To measure the frequency response of cartridge, a test record with sweep signal recorded must be played with a turntable.

1. Play the test record under the test cartridge, to be measured, and feed the output of the turntable to the input terminals of the preamplifier. Connect the REC output terminals of the preamplifier to the INPUT TERMINALS "1" and "2" of the SD-1000. Be sure to connect the left-channel leads to the INPUT TERMINALS "1"; the right-channel leads to the INPUT TERMINALS "2".
2. Set the FUNCTION SWITCH to WAVEFORM, and the FRONT-REAR SELECTOR SWITCH to FRONT.
3. For observing the frequency response of left-channel, depress the WAVEFORM & DISPLAY SELECTOR SWITCH "1"; for observing the frequency response of right-channel, depress the WAVEFORM & DISPLAY SELECTOR SWITCH "2".
4. Adjust the amplitude of the waveform by controlling the VERTICAL GAIN KNOB and the HORIZONTAL GAIN KNOB, and control the SWEEP RANGE SWITCH and the SWEEP VARIABLE CONTROL KNOB so that the pattern may stay on the CRT screen stationarily.
5. If the frequency response of the measured cartridge is flat, the CRT screen will show a pattern like (a) of Fig. 25, if the frequency response is rising in both high range and low range, the pattern on the screen will show a pattern like (b); and if the frequency response is lowering, in both high range and low range, the screen will show a pattern like (c).

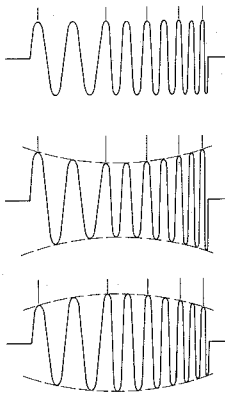


Fig. 25

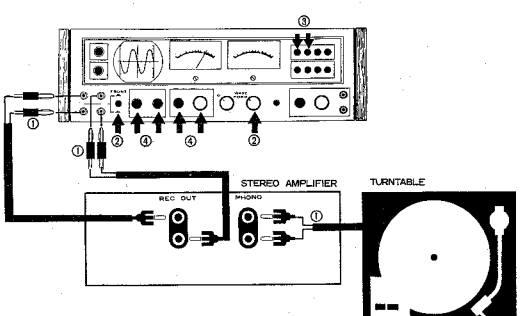


Fig. 26

CHECKING TRACKABILITY

Provide the same connections as in the case of "checking of frequency response", and play a trackability test record. If the CRT screen shows such patterns as shown in Fig. 27, it indicates that tracking is not proper. In this case, it is suggested that the turntable be adjusted.

CHECKING CHANNEL SEPARATION

Provide the same connections as in the case of "Checking of frequency response", and play a channel separation test zone of the test record.

1. Set the FUNCTION SWITCH to DISPLAY, and depress the WAVEFORM & DISPLAY SELECTOR SWITCH "1" and the DISPLAY SWITCH "2".
2. With the above setting, the LEVEL METER (VERT) will indicate the level of left-channel signal; and the LEVEL METER (HORIZ), the level of right-channel signal.
3. The difference between the reading on the LEVEL METER (VERT) and that on the LEVEL METER (HORIZ) is the channel separation of the tested cartridge. For instance, if only left-channel signal has been reproduced and the LEVEL METER (VERT) indicates -2 dB and the LEVEL METER (HORIZ) indicates -20 dB, the channel separation of the cartridge at a given frequency is 18 dB.
   i.e. Channel separation = (-2 dB) - (-20 dB) = 18 dB

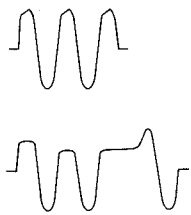


Fig. 27

LINE VOLTAGE SELECTOR AND FUSE

SWITCHING LINE VOLTAGE SETTING AND FUSE

To remove the fuse, turn the fuse cap located on the line voltage selector switch in the direction indicated by the arrow. Then remove the fuse plug from the unit. Put the fuse plug back so that the proper line voltage marking can be seen through the cut on the edge of the plug. Whenever the position of the selector switch is changed, check the rating of the fuse. A 1.5-ampere fuse is to be used for either 220V or 240V operation and a 3-ampere fuse for 110V, 120V or 130V operation. If the rating of the fuse is correct, replace cap.

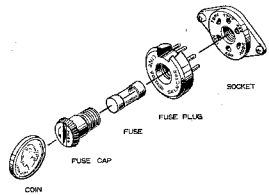


Fig. 28

FUSE REPLACEMENT

If the fuse blows, remove the fuse cap and replace the fuse with a new one.

CONDITIONS FREQUENTLY MISTAKEN FOR MALFUNCTION

The SD-1000 precision test equipment also has many controls, therefore even a rudimental mis-operation may show a symptom which may be taken for a trouble. If any abnormal phenomenon is noticed in your SD-1000, check the equipment for a possible cause and a correct remedies by referring to the following table.

	Symptom	Possible cause or reason	Remedies
Cathode-ray tube screen	With the FUNCTION SWITCH on, power is not supplied.	• Fuse has blown (a) • Power cord is not plugged in the outlet completely. (b)	(a) Check the fuse. (b) Check the connection.
	Bright line will not appear on the CRT screen.	• INTENSITY knob on the rear panel is turned fully counterclockwise. (a) • The VERTICAL and the HORIZONTAL POSITION KNOBS are not set to proper positions. (b)	(a) Readjust the INTENSITY knob to obtain the optimum brightness. (b) It is suggested that the POSITION KNOBS be set to the middle point of the controlling range.
	Spot is dark or no spot on the CRT screen.	• Spot killer circuit is working.	• Feed input signal to the INPUT TERMINALS "1" or "2", and obtain a waveform having an amplitude of more than 3/8" The spot killer circuit will be released.
	Pattern on the CRT screen is out of focus.	• When brightness is adjusted.	• Adjust the FOCUS control knob on the rear panel to obtain the sharp focus.
	Pattern on the CRT screen vacillates.	• Interference between measuring frequency and the line frequency. (a) • Interference by magnetic AC flux. (b) • The line voltage is not stable. (c)	(a) Use a frequency slightly different from the line frequency. (b) Do not use the SD-1000 near a transformer or a motor with large leakage flux. (c) Provide a voltage regulator to the power cord to obtain the rated voltage.
	Only horizontal or vertical pattern appears on the CRT screen.	• The GAIN CONTROL KNOB is at the minimum position. (a) • Connection of cords is not complete. (b)	(a) Reset the knob to the proper position. (b) Connect the cords completely.
Audio oscillator	No oscillating output.	• The OSCILLATOR LEVEL CONTROL KNOB is at the minimum position or at OFF. (a) • Oscillation seems to stop during an auto sweep operation. (b) • If the OSCILLATOR FREQUENCY CONTROL KNOB is turned too quickly, oscillation may stop. (c)	(a) Reset the knob to a proper position. (b) An automatic sweep operation resumes in more than 10 seconds after a previous automatic sweep operation has completed. Do not fumble with any switch and knob until a sweep operation resumes. (c) Return the knob to a lower frequency position and turn it back to the desired position gently.
	Output is too small.	• A device having an impedance lower than 10 kΩ is connected to the output terminal of the SD-1000.	• A device to be connected to the output terminals should have an impedance higher than 50 kΩ, if possible.
	Output is distorted.	• If the OSCILLATOR LEVEL CONTROL KNOB is set to the maximum with a low impedance connected to the OSCILLATOR OUTPUT TERMINALS, it will cause an overload.	• Connect a device having an impedance higher than 50 kΩ.
Level meters	Level meter will not deflect.	• Connection of cords is not complete. (a) • The LEVEL METER SELECTOR SWITCH is set to OFF (b)	(a) Connect the cords completely. (b) Turn the switch clockwise.
	Level indicated by the LEVEL METER does not agree with the level of the pattern on the CRT screen.	Response time of meter deflection is 0.3 sec, but no scope circuit has time delay, also meter indicates average value and scope shows peak value of voltage.	This phenomenon is by no means a trouble, but an essential matter. Take advantage of this feature.